RESUMING AN INTERNATIONAL PROJECT: MAP USE IN ARGENTINE AND HUNGARIAN SCHOOLS

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Abstract: *This project was organized on the scope of a bilateral agreement signed by the Argentine and Hungarian governments to support researches in different fields. A special characteristic of this research was that it was made in countries with different educational systems and without any common investigation in this theme till now. Participants made two surveys about the use of maps in schools, asking pupils about two specific themes: thematic maps and relief representation methods. Our main aim was to identify the difficulties faced during the using of maps in schools and to recognize the positive experiences in interest of possible mutual adoption of them, included in the final proposal of the project. The data was stored in digital format and the results of analysis were also presented using different types of charts. Databases and results were placed to the Web, facilitating the free consult of specialists from other countries.*

THE FIRST STEPS: ORGANIZING THE INTERNATIONAL PROJECT

A bilateral agreement for the support of scientific research, signed by the Argentine and Hungarian governments, was announced in 2003. Representing the fields of cartography, geography and pedagogy, Hungarian and Argentine specialists presented a common project entitled "Map reading by children in school age: Cartographic education and practice in Hungary and Argentina". The project was approved for a period of two years between 2004 and 2005 and it was divided in two parts:

- 2004: study of the use of thematic maps in elementary and secondary schools, how pupils and teachers use these maps in their daily work after the study of the elemental cartographic concepts.
- 2005: study of the understanding of methods of relief representation in different kinds of maps used in schools.

The first part of the project included the making and applying of a survey on thematic maps in both countries. This task was completed during 2004 and the analysis of the results was completed in the first three months of 2005. At same time the research teams began to collect data about the methods of relief representation and to plan the next questionnaire, which was executed during 2005 in both countries. The results and previous conclusions were presented in the two last ICC Conferences (2005 in Spain and 2007 in Russia). This paper aims to present a summary of the whole project, its' final results, conclusions and proposals.

PREVIOUS RESEARCH ON THE EDUCATIONAL SYSTEMS

Our first task before making the test for the survey related to thematic maps was the study of the characteristics of both educational systems. Research teams had two main aims to reach with this investigation:

- To know in which grades the pupils learn the elemental concepts related to maps, when they begin to apply theses concepts in practice and what kind of maps they use in the classroom, emphasizing which methods of thematic representation and methods of representation of relief can be found on these maps
- To design the specific content of the test, determining what kind of questions we can make to the pupils according to their knowledge.

Based on this study (presented also in earlier conferences) we decided to apply the planned test to 7th grade pupils of Elementary Schools in the case of Hungary and to 1st year pupils of Secondary School in Argentina.

DESIGN AND STRUCTURE OF THE TESTS

The questionnaires were planned according to the same principles in both countries, asking about the same themes in each country. But considering that Argentine and Hungarian pupils emphasized different themes in their respective educational systems, the tests could not be identical. This is the reason because we can find that a specific theme can be asked using different territories, countries or data in the questionnaires (Table 1).

In the interest of planning a cheap survey, we took the decision of printing the test in A5 format, with a maximum of four questions printed on both sides. The first questionnaire (related to thematic maps) was printed entirely in black and white in both countries. In the second test, we faced a particular situation, namely, school atlases and physical wall maps represented the relief mainly using coloured hypsometry. The participant colleagues considered it very important to include a question measuring how pupils can read and understand information represented in a colour hypsometric map. However, this solution makes the costs of production more expensive and the Argentine specialists did not have any kind of financial support to execute the survey. In consequence, they had to simplify this question by printing it in black and white.

Table 1

CONTENT OF THE TWO SURVEYS			
THEMATIC MAPS		**RELIEF REPRESENTATION METHODS**	
ARGENTINA	**HUNGARY**	**ARGENTINA**	**HUNGARY**
FIRST QUESTION:			
Evaluation of two methods (dots and choroplets), representing similar data (population and density of population).		Identification of three elemental landforms (high mountains, mountains and hills) with three selected methods of representation (Erwin Raisz's physiographic method, isolines and hypsometry). This was the last question in the Argentine test.	
Maps: China and South Africa	Maps: China and Venezuela	Fragments of imaginary maps.	
SECOND QUESTION:			
Historical map about the exploration of African coasts by the Portuguese navigators in the 15th century.		Understanding the joint use of isolines and hypsometry	
Map: Africa		Map: Fragment of an imaginary map.	
THIRD QUESTION:			
Reading and joint analysis of two methods of representation (diagrams and choroplets) in the same map.		Use of an isoline map, to measure competences related to the reading and understanding of tourist maps.	
Map: Districts of Buenos Aires	Map: Hungary by provinces	Map: Fragment of an imaginary map.	
FOURTH QUESTION:			
Drawing of thematic information on an outline map, based on annexed data and legend.		Use and understanding of hypsometry. This was the first question of the test in Argentina.	
Map: Districts of Buenos Aires	Map: Western provinces of Hungary	Map: Black and white map of an imaginary mountain	Map: Hypsometric colour map of an imaginary island
Download the tests from: http://lazarus.elte.hu/hun/dolgozo/jesus/mag-arg/1/ekutatas.htm		Download the tests from: http://lazarus.elte.hu/hun/dolgozo/jesus/mag-arg/2/ekutatas.htm	

PARTICIPATION IN THE SURVEYS

During the first year, the Hungarian organizers tried to select participant schools was made in a representative way, intending to have at least one school from each county, and to have a similar proportion of schools in cities and smaller towns (44 schools from 34 cities and 24 schools from 24 towns were asked to participate). From the sixty-eight contacted schools a total of thirty-eight sent back their answers. In the second year, the Hungarian specialists contacted again those schools were sent their answers to the first questionnaire. The participation in this period was less active than in the first one: a total of fourteen from the thirty-eight contacted schools sent back their answers from Budapest and seven counties.

The Argentine organizers faced more difficulties to distribute their questionnaires at a national level: the large extent of the country (the province of Buenos Aires is equivalent to the whole territory of Hungary), and the difficult communication with the remote regions was a serious obstacle that was also aggravated by the unstable economic

situation. They made and distributed the tests without any financial support. Finally, they succeeded in collecting answers from schools in the province of Buenos Aires.

The time given by the teachers to answer the test varied between the participant schools. The Hungarian organizers asked 73 teachers during the first survey and based on their answers, 9.7% of pupils had more than 30 minutes to complete the test, 33.3% of pupils had between 21 and 30 minutes, 15.3% had between 16 and 20 minutes, 29.2% had between 10 and 15 minutes and finally 12.5% had less than 10 minutes.

The number and age data of the participants are listed in the Table 2.

Table 2

THEMATIC MAPS		RELIEF REPRESENTATION METHODS	
ARGENTINA	**HUNGARY**	**ARGENTINA**	**HUNGARY**
NUMBER OF PARTICIPANTS			
567	1534	484	585
DISTRIBUTION BY AGE			
13 years old – 48% 14 years old – 42.7%	12 years old – 14% 13 years old – 72.7% 14 years old – 11%	13 years old – 46% 14 years old – 42.9%	12 years old – 4.4% 13 years old – 62.3% 14 years old – 24.6%

GENERAL RESULTS OF BOTH TESTS

The obtained results are summarized in Table 3 and 4, annexed at the end of this paper.

SOME EXAMPLES PRESENTING THE RESULTS

Because of the limited space, it is very difficult to present in detail the results of the analysis of the answers given to the two questionnaires. In this chapter the authors tried to make a representative selection of the most interesting results accomplished during the project:

Questionnaire about thematic maps

1. Very different results were obtained during the evaluation of the understanding of a dot map of China (Figure 1). Pupils had to answer a question determining the territory (A or B) with a highest density of population . The majority of the Hungarian pupils gave a correct answer (83.1%), but 94.7% of Argentine pupils left this question in blank. This was an unexpected result and the Argentine colleagues' opinion is that this high percentage of no answers could have a main cause: namely, pupils do not work with this method of thematic representation in the classroom.

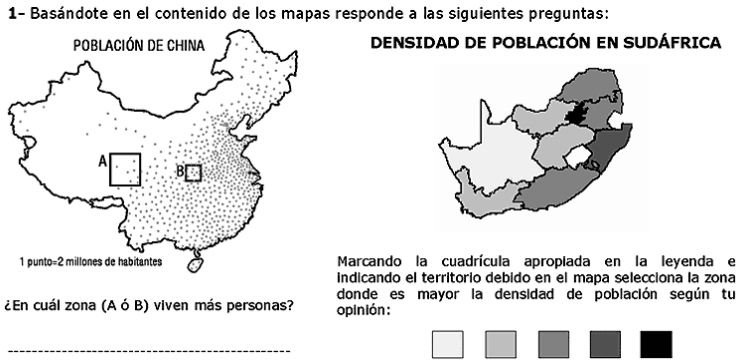

Figure 1. First question of the Argentine test

2. The results reading thematic information from a historical map were similar in both countries (Figure 2). The percent of pupils that made at least an error reading the map was 67.3 in Hungary and 65.7 in Argentina. But more exactly 51.6% of this group of pupils made only one mistake and 23.5% two mistakes in Hungary, and in Argentina this proportion was also similar: 39 and 27%. A frequent mistake was the change of digits of a year (for example, writing 1842 instead of 1482) or the change of the discoverers' name (writing Vasco da Gama instead of Bartolomeu Dias). The motive of this last kind of mistake is probably explained by the fact that the pupils could not read correctly the data in the map: at this point of the map (South of the African continent) four data were represented in a very small space (the

page format for the test was A5) and on other hand the location of the lines showing the two discoverers' routes were very close to each other.

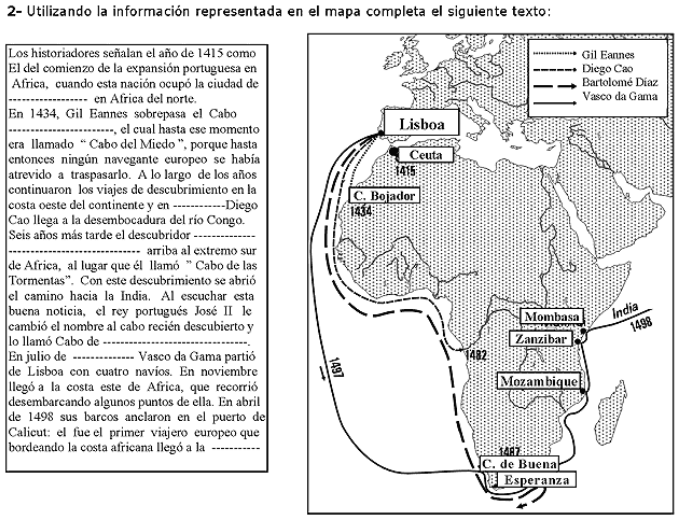

Figure 2. Historical map in the Argentine test

3. The question using choroplets and diagrams to represent the thematic information raised the highest interest among Hungarian researchers, because it was planned to evaluate the children's capacity not only to read, but also to analyze the represented information (Figure 3). Argentine colleagues decided to ask pupils only about the reading of this kind of maps, omitting the last part of the question (joint analysis of choroplets and diagrams). The Hungarian results indicated the problems that pupils face to analyze the information represented together using different methods in the same map: as can be read in the table X, they had no difficulty to read information from a column of a diagram or from the whole diagram. But when they were requested to analyze diagrams and choroplets together 40% of the answers were erroneous. A total of 101 pupils did not answer this question; they were not included in the calculated 40%. A possible reason of the questions without any response can be the shortage of time. But at same time we could observe that those pupils, who gave right answers to the first two points, did not response correctly this one. In other words, they are able to read literally the values in a diagram, but they do not have the sufficient practice for the analysis of the information.

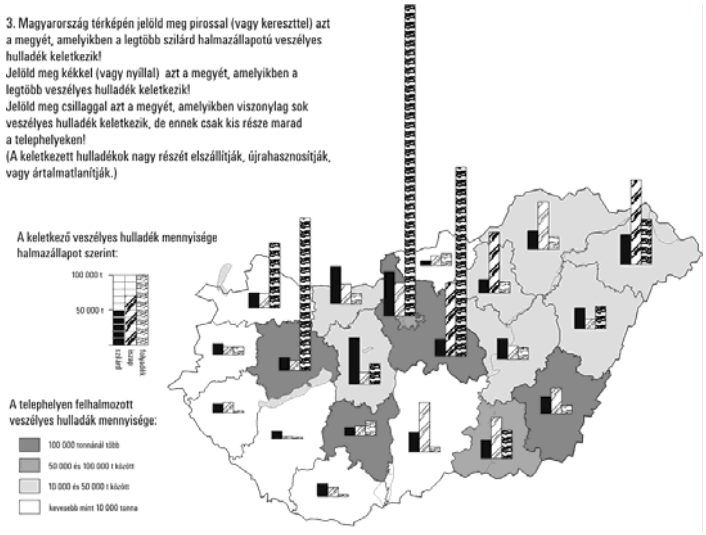

Figure 3. Thematic map in the Hungarian test

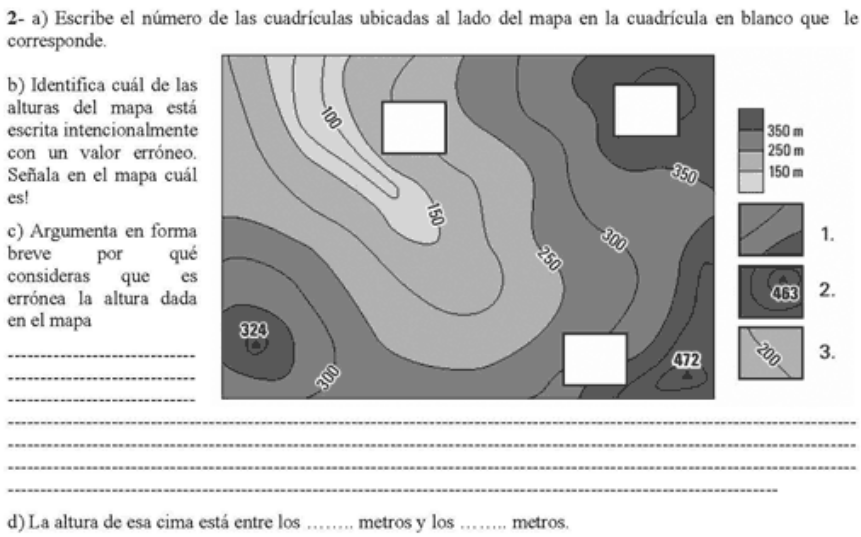

Figure 4. Isolines and hypsometry in the same map (Argentine test)

Questionnaire about methods to represent the relief

1. The question presenting a map made simultaneously with isolines and hypsometry had a main aim: to picture how hypsometry is derived from the isolines, but not being the same method of representation (Figure 4). In Hungary, the more negative result was reached when they had to identify the wrong altitude represented in the map: 79% of the pupils' answers were erroneous. An interesting detail is that this result is inversely proportional to the next point (to explain why the altitude represented in the map is wrong), because 60.3% of the pupils explained it correctly. This result could be originated by two reasons: A considerable percent of the errors identifying wrong altitude could be provoked by the pupils' inattention comparing high areas filled in dark grey tones and the correct association of the darkest tones with the highest areas, but pupils did not take into consideration the 50 m interval between each isoline. In this specific question, the results of the Argentine test conducted inversely proportional to the Hungarian ones: more pupils identified correctly the wrong altitude (49.5% of Argentine pupils against 21% of Hungarian answers), but fewer pupils explained properly their decision (23.9% in Argentina and 60.3% in Hungary).

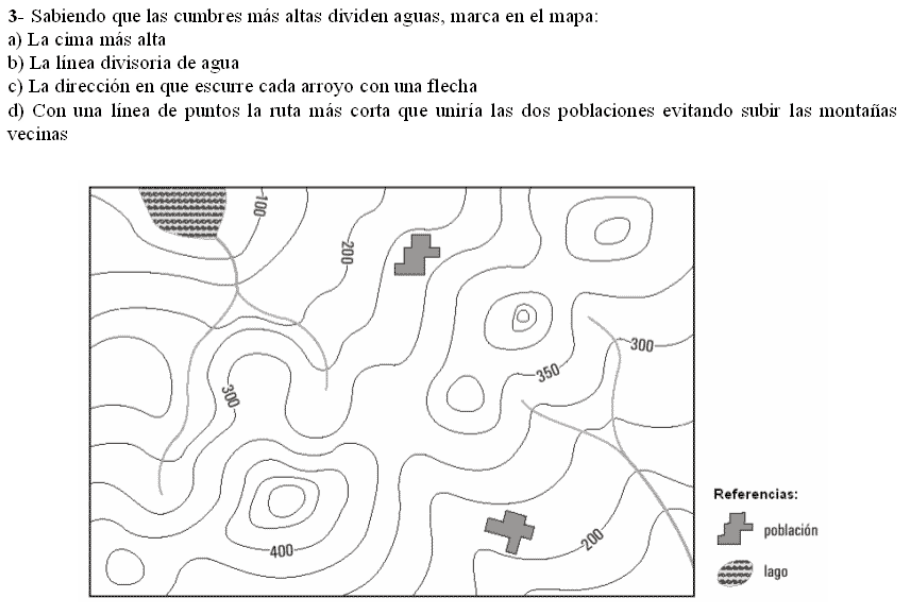

Figure 5. Using an isoline map (Argentine test)

2. In Hungary, the results of the question about the use of an isoline map made in black and white can be considered satisfactory and the majority of pupils completed correctly the tasks based on the reading of isolines (Figure 5). The number of blank answers was relatively high (130), and the main difficulties were drawing the ridge of the mountains in the map and indicating the shortest route between two settlements avoiding the neighbour mountains. Answers to this

last question indicated difficulties in the practical use (that is the reading and understanding) of concepts related to isolines.

The Argentine results inferred more difficulties: the number of right answers was under 50% in three of the four topics included in this question. The worst result was obtained when pupils had to draw the ridge of the mountains: the percent of blank answers was 43,8 (the highest value in the survey) and only 9.5% of correct answers. After it, the results of the last part (to mark the shortest route between two settlements by-passing the neighbour mountains) constituted a surprise for the specialists, when nearly 60% of the answers were right (the third best result in the Argentine survey).

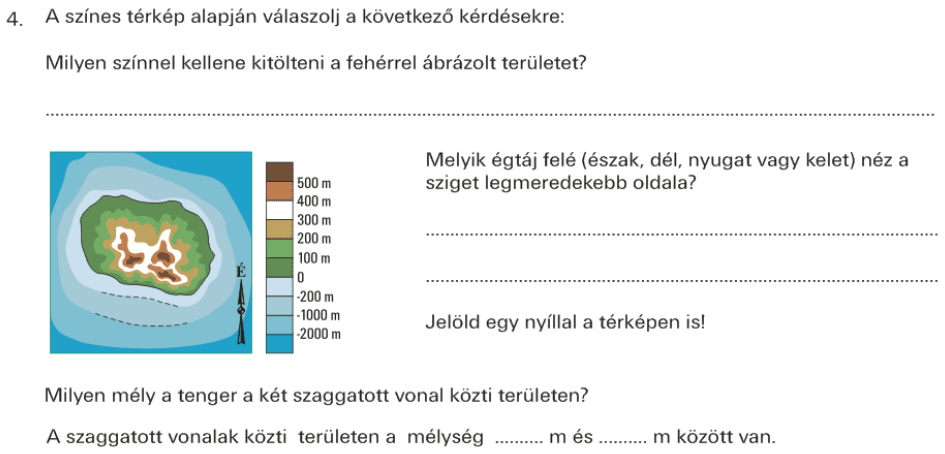

Figure 6. Hypsometric map (Hungarian test)

3. The question designed to evaluate the understanding of hypsometry in a coloured map (Figure 6) was satisfactorily solved by the Hungarian pupils, keeping the percentage of wrong answers between 16 and 24%, which was the second best result in the test. We should remark that Hungarian specialists had the opportunity to print a colour map for this question, and this situation facilitated that pupils identified easier the hypsometry as a method of representation used in the Hungarian school atlases. The results obtained in Argentina were contradictories: despite of printing the question in black and white, the percent of correct answers to the first part (determining colour to fill an area in blank) was high (77.5%), but at same time more than 58% of the pupils could not determine the hairiest slope in the map. This last result can be traced back to problems understanding isolines –which are the base to understanding the hypsometry in a map– and to the actual lack of school atlases in the country, constituting an evidence on the fact that maps in textbooks can not substitute the schools atlases in the Geography education.

GENERAL PROPOSALS

After our joint research, the participant teams worked out several proposals related to the teaching of map concepts in schools:

Table 5

Common proposals:
- The development of map reading competences of the pupils cannot be considered enough at the present stage, the map understanding competences should also be developed. The utility of this development can be noted, first of all, during the use of thematic maps during the learning activities, embracing simultaneously different subjects, specialties and fields of literacy. The development of these competences actually is also included in the study plans of the participant countries, but the results obtained during this survey indicate its practical realization is not always materialized. The causes of this situation would need further investigation to propose more concrete solutions. - An important requisite of publishing a school textbook should be a more careful selection (or edition) of the maps to be included, taking in consideration which concepts will be illustrated by maps and, if necessary, modifying the maps in function of the pupils' knowledge. During the edition of textbooks, it is recommendable to request the service of a cartographer, e.g. to include one as a member of the Editorial Board. - The use of satellite images in the textbooks and atlases is recommended, which help the pupils to understand the content of the physical maps by visualizing the represented territories in their natural dimension.

Specific proposals by country	
Argentina	**Hungary**
- The systematic edition of school atlases is very important in the interest of an integral geographic education: the atlases printed for the general public or the maps included in text- or workbooks cannot substitute them. The pertinent authorities responsible for the publication of textbooks for schools should consider the achievable proposals to find a solution to the absence of Argentine school atlases in the Argentine system of education. - The research team considers it useful to review the Hungarian experiences in the state financial support of the edition of textbooks and school atlases.	- Maintenance or increment of the actual level of quality of the Hungarian school atlases. - The actual study plans do not include any theme dedicated specially to the reading of thematic maps. Pupils read and use some types of charts in subjects related to Mathematics (it is a very positive experience that demonstrates the interrelation between different subjects), but in subjects related to Geography there is no any theme about other methods of thematic representation (dot, flow, non-physical use of isolines, etc). Considering that the maps are interdisciplinary learning tools (used in other subjects as History, Literature, etc.), we propose the analysis by pertinent authorities of a possible introduction of the teaching of these concepts.

People interested in this research can find free access to all the databases, documents, etc. related to this project visiting the following site: http://lazarus.elte.hu/hun/dolgozo/jesus/mag-arg/proyect1.htm. All the documents are available in the language of the participant countries (Spanish and Hungarian).

The results were sent by the organizers to all the participating schools. Different documents presenting and analyzing the results of the survey was also placed on the website. These reports sums up the positive experiences detected during the teaching and practical use of map concepts, drawing up those ideas and suggestions that could be applied mutually in both countries. The results have been presented in various national and international conferences, and the participating specialists are also promoting the results in Argentine and Hungarian institutions related to educational activities in the fields of geography and cartography (ministries, research institutes, teachers' organizations, etc.).

FUTURE RESEARCH

The research teams plan to continue the collaboration also in other cartographic themes and their practical use (application) in activities closely related to the education of the young generations. Following research related to thematic cartography, both teams presented a new proposal for the 2008-2009 period under the title "The possible uses of the Chernoff faces for data visualisation in school cartography", to study alternative methods of thematic representation that can be also used in school cartography.

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This paper was written in the framework of activities of the MTA-ELTE Research Group on Cartography and GIS, financed by the projects ARG-6/03 of the Hungarian Ministry of Education and A/0029/2004 of the Hungarian OKTK Foundation, and the project HU / PA03 – UVII / 002 of the Argentine SECYT-ME.

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Table 3

USE OF THEMATIC MAPS (1st PART OF THE PROJECT)						
RESULTS OF THE SURVEY FOR PUPILS						
	ARGENTINA			**HUNGARY**		
1st QUESTION: Similar information represented by points and choroplets in different maps						
	Right answers	Wrong answers	No answer	Right answers	Wrong answers	No answer
Map of China: -Territory with highest number of inhabitants	489	75	3	1418	116	-
-Territory with highest density of population	22	8	537	1260	273	1
Map of Venezuela/South Africa: -Highest density of pop. in the legend	394	126	47	1160	374	-
-Highest density of pop. in the map	137	43	387	807	727	-
2nd QUESTION: Filling of text based on information represented in historical map						
	Right answers	Answers with one or more errors	No answer	Right answers	Answers with one or more errors	No answer
Topic: Exploration of the African coasts in the 15th century.	180	373	14	501	1033	-
3rd QUESTION: Analysis of two methods of representation (diagrams and choroplets) in the same map						
	Right answers	Wrong answers	No answer	Right answers	Wrong answers	
-Reading of information represented in a column of a diagram	378	13	176	1386	47	
Hungary: -Reading of information represented in the diagram Argentina: -Reading of information represented by choroplet	415	121	31	1251	182	
-Joint analysis of information represented by diagram and choroplet	-	-	-	818	615	
				No answer: 101		
4th QUESTION: Drawing of a thematic (choroplet) map						
Task: Making of a choroplet map Hungary – Map of the West Hungarian counties Argentine – Map of some districts of Buenos Aires	Correct categoriz.	Wrong categorization	Quality of work	Correct categoriz.	Wrong categoriz.	Quality of work
	434	112	High:137 Ave.: 182 Low: 217 No ev: 31	1147	248	High: 1075 Ave.: 214 Low: 104 No eval: 3
	No answer: 21			No answer: 138		

Table 4

UNDERSTANDING OF METHODS OF RELIEF REPRESENTATION (2nd PART OF THE PROJECT)						
RESULTS OF THE SURVEY FOR PUPILS						
	ARGENTINA			**HUNGARY**		
Connecting the name of landforms to their representations using different methods						
	Right answers	Wrong answers	No answer	Right answers	Wrong answers	No answer
High mountains	314	135	35	509	71	5
Mountains	171	275	38	392	189	4
Hills	164	282	38	396	185	4
Question on understanding of hypsometry and isolines (black and white map)						
	Right answers	Wrong answers	No answer	Right answers	Wrong answers	No answer
Filling the blank areas in the map	438	33	13	562	20	3
Identification of wrong altitude in the map	240	126	118	123	354	108
Explanation about wrong altitude	116	221	147	353	125	107
Determination of correct altitude	43	321	120	239	243	103
Use of an isoline map made in black and white						
	Right answers	Wrong answers	No answer	Right answers	Wrong answers	No answer
Indication of the highest peak in the map	148	227	109	476	72	37
Indication of the ridge of the mountains	46	226	212	378	77	130
Indication of the course of the creeks with an arrow	163	178	143	486	54	45
Shortest route between two settlements by-passing neighbour mountains	287	65	132	448	7	130
Question on understanding of hypsometry (in Hungary – coloured map)						
	Right answers	Wrong answers	No answer	Right answers	Wrong answers	No answer
Which colour should be used to fill the blank area?	375	73	36	437	94	54
Which is the hairiest slope (side) of the island?	144	285	55	451	95	39
How deep is the sea within the area delimited by broken lines?	-	-	-	410	141	34
Total of participants by country	484			585		